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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TIMOTHY J. PHILLIPS
and TIMOTHY ASHLEY

Appeal 2009-007560
Application 10/577,938
Technology Center 2800

Decided: May 25, 2010

Before MARC S. HOFF, CARLA M. KRIVAK,
and THOMAS S. HAHN, *Administrative Patent Judges*.

HAHN, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants invoke our review under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1-14 and 16. We have jurisdiction under 35 U.S.C. § 6(b). An oral hearing was held on April 13, 2010. We affirm-in-part.

STATEMENT OF THE CASE

Appellants claim a transistor having a narrow band gap region material that is mechanically strained to be compressed, and that also is p-type doped to contain an excess of holes.[1] Claim 1 is illustrative:

> 1. A transistor including at least one narrow bandgap region under compressive mechanical strain comprising at least one of a doped p-type material and a material containing an excess of holes.

The Examiner relies on the following prior art references to show unpatentability:[2]

Phillips ("Phillips '337")	WO 01/93337 A1	Dec. 6, 2001
Phillips ("Phillips '674")	WO 03/081674 A1	Oct. 2, 2003

1. The Examiner rejected claims 1-9, 12-14, and 16 under 35 U.S.C. § 102(b) as being anticipated by Phillips '674 (Ans. 3).

2. The Examiner rejected claims 1, 10, and 11 under 35 U.S.C. § 102(b) as being anticipated by Phillips '337 (Ans. 3).

Rather than repeat the Appellants' or the Examiner's arguments, we refer to the Appeal Brief filed June 9, 2008, the Examiner's Answer mailed Sep. 2, 2008, and the Reply Brief filed Nov. 3, 2008 for their respective details. In this decision, we have considered only those arguments actually

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[1] *See generally* Spec. 4:26-5:17; 5:22-6:21; Fig. 1.

[2] A rejection under § 112, first paragraph, of claims 9 and 16 as failing to comply with the written description requirement (*see* Office action mailed Nov. 29, 2007, ¶¶ 1, 2) is reported in the Examiner's Answer as withdrawn (Ans. 3, 4). Accordingly, this rejection is no longer an adverse decision for this appeal.

made by Appellants. Arguments that Appellants could have made but did not make have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

Appellants' Arguments

Appellants contend for grouped claims 1-9, 12-14, and 16 that independent claims 1 and 16 are not anticipated by Phillips '674 (App. Br. 8-10) because the reference fails to teach "any doping which would inherently provide 'at least one narrow bandgap region under compressive mechanical strain'" (App. Br. 9).

Appellants contend for grouped claims 1, 10, and 11 that independent claim 1 is not anticipated by Phillips '337 (App. Br. 11) because the reference fails to teach a "bandgap region 'under compressive mechanical strain'" (*id.*).

ISSUES

Have Appellants shown the Examiner erred in rejecting independent claims 1 and 16 under § 102(b) by finding Phillips '674 expressly or inherently teaches doping a material to form a narrow band gap region that is under compressive mechanical strain?

Have Appellants shown the Examiner erred in rejecting independent claim 1 under § 102(b) by finding Phillips '337 expressly or inherently teaches a band gap region under compressive mechanical strain?

FINDINGS OF FACT

The record supports the following Findings of Fact (FF) by a preponderance of the evidence:

Present Application

1. Appellants' Specification acknowledges that application of strain is a prior known way to alter semiconductor characteristics (1:15-16), and that aluminum (Al) atoms in an $Al_xIn_{1-x}Sb$ lattice reduces its lattice constant relative to adjacent InSb material that can thereby be strained (1:16-20).
2. Appellants' Specification then categorically discloses that "the presence of an $Al_xIn_{1-x}Sb$ layer or layers having a significantly lower lattice constant will introduce a strongly compressive strain into the [InSb] quantum well or base region respectively" (3:26-30).
3. A transistor embodiment described in Appellants' Specification includes a p-type doped InSb layer (5) quantum well positioned between $In_{1-x}Al_xSb$ layers (3-7) (4:18-19; 4:26-5:7; Fig. 1). The value for "x" in the $In_{1-x}Al_xSb$ layers 4 and 6, adjacent to quantum well layer 5, is in the range of "0.15-0.30," which is disclosed as being "high enough to induce sufficient strain in the layer 5 that the light and heavy holes are separated by an amount much greater than kT" (5:8-17).

Phillips '674

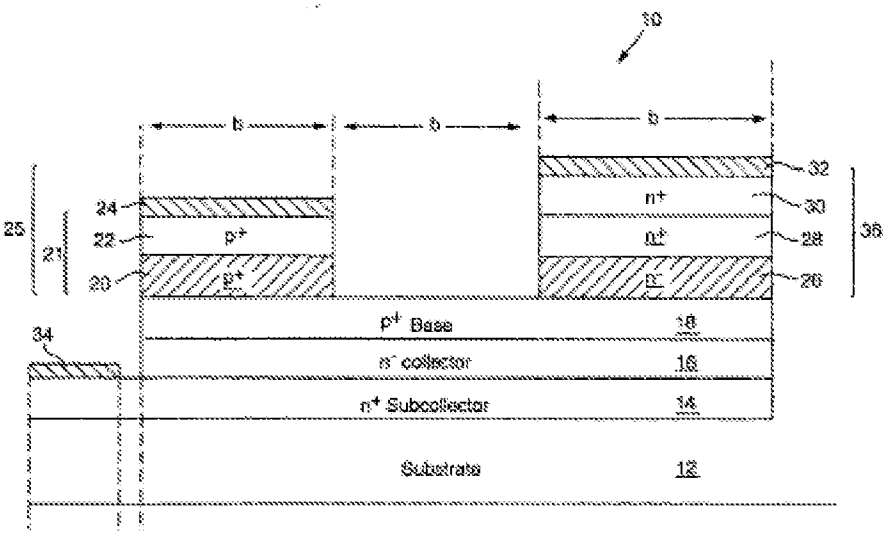
4. Phillips '674 discloses transistor embodiments having a primary conduction channel formed from a low band gap InSb layer (22) bounded above and below by secondary conduction channels of

$In_{1-x}Al_xSb$ layers (21 and 23) (Abstract; 10:5-24; Figs. 4, 7, and 8).

5. Phillips '674's InSb layer transistor embodiments are disclosed as alternatively being configured with "no strain" (10:10-12), "with strain" (10:12-14), or "strain balanced" (10:15-21). The "strain balanced" embodiment is disclosed as including $In_{0.85}Al_{0.15}Sb$ and $In_{0.70}Al_{0.30}Sb$ layers (*id.*).
6. For one transistor embodiment, the Phillips '674 InSb layer (22) primary conduction channel is disclosed as being undoped as are other layers, which are disclosed as "nominally undoped, but may contain unintentional doping of either type" (10:15-22).

Phillips '337

7. Phillips '337 discloses a narrow band gap bipolar transistor having a p^+ doped InSb base layer (18) contacting an $In_{0.85}Al_{0.15}Sb$ layer (20) and also contacting an $In_{0.95}Al_{0.05}Sb$ layer (26) (3:15-35; Fig. 1 (reproduced below for reference)).



Reproduction of Phillips '337 Figure 1 Showing a Vertical Cross-Section of a Narrow Band Gap Bipolar Transistor

PRINCIPLES OF LAW

Analysis of claim rejections begins with a determination of claim scope. We determine claim scope not solely on the basis of claim language, but also on giving claims their broadest reasonable construction in light of the specification as it would be interpreted by one of ordinary skill in the art. *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). *See also Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004) ("Though understanding the claim language may be aided by explanations contained in the written description, it is important not to import into a claim limitations that are not part of the claim.").

A rejection under 35 U.S.C. § 102 is established only when a single prior art reference discloses, expressly or under principles of inherency, each

and every element of a claimed invention as well as disclosing structure which is capable of performing the recited functional limitations. *RCA Corp. v. Appl. Dig. Data Sys., Inc.*, 730 F.2d 1440, 1444 (Fed. Cir. 1984); *W.L. Gore & Assoc., v. Garlock, Inc.*, 721 F.2d 1540, 1554 (Fed. Cir. 1983). "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teaching of the applied prior art." *Ex Parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).

ANALYSIS

Claims 1-9, 12-14, and 16

Based on the record, we are persuaded the Examiner erred under § 102(b) in rejecting claims 1-9, 12-14, and 16 as being anticipated by Phillips '674.

Appellants collectively argue the two independent claims 1 and 16 (App. Br. 8-10; Reply Br. 2-9).

The Examiner's statement of reasons for rejecting all of these claims is:

> Phillips '674 show all aspects of the instant invention (e.g.[,] Figure 4) including a quantum-well FET with a narrow bandgap region 22 made of InSb, with two further layers 21, 23 on each side subjection [sic] said narrow bandgap region providing compressive mechanical strain and primary/secondary conduction channels, being no more than 0.4 eV and a layer of p-type material (Page 10 Lines 21 and 22) and partly

> intrinsic conduction and said transistors in logic circuits (Page 4 Lines 11 to 14).

(Ans. 3). Appellants dispute these Examiner findings by contending that Phillips '674 fails to teach "any doping which would inherently provide 'at least one narrow bandgap region under compressive mechanical strain'" (App. Br. 9).

The thrust of Appellants' Appeal Brief arguments is that Phillips '674 fails to teach compressive strain of a narrow band gap region material (*id.*). For example, Appellants preface the above reproduced assertion of Phillips '674 failure with reference to an Examiner cited Phillips '674 disclosure concerning doping semiconductor materials, and argue that such "language has nothing to do with any mechanical straining of any layer, let alone compressive strain of the narrow bandgap region" (*id.*) (emphases deleted). The Examiner, in response, explains that Phillips '674 disclosures at page 10, lines 21-22, "were listed . . . to support . . . the p-doping of the layers, not to support doping as the source of compressive strain, as mistakenly interpreted by the Appellants" (Ans. 4, 5).

It is in the Reply Brief that Appellants address the claimed p-type doping of narrow band gap material and what is or is not disclosed in Phillips '674.

> Phillips, at page 10, line 17 specifically requires that the "primary conduction channel 27 (22) is of undoped indium antimonide ...." (emphasis added). Channel 22 in figure 7 is the same as channel 22 in Figure 4 (which does not describe the channel as being doped). Accordingly, even if there were some of the required compressive

> strain, the purported narrow band gap "region 22" in Phillips '674 does not meet the requirements of independent claims 1 and 16.

(Reply Br. 3).

Turning to Phillips '674, we find Appellants are correct in asserting that the reference teaches a transistor embodiment having an undoped indium antimonide primary conduction channel (FF 6). For this embodiment, we also find the Examiner is correct in asserting that the reference teaches that layers are "nominally undoped, but may contain unintentional doping of either type" (Ans. 4; FF 6). However, other than citation to page 10 of Phillips '674, the Examiner is silent as to how and what significance is attached to the disclosed "unintentional doping of either type" in context with the also disclosed "nominally undoped." On this record, we do not find the recited p-type doped narrow band gap material taught, nor do we find facts or reasoning provided that such doped material is necessarily present as would be recognized by skilled artisans. Consequently, for us to sustain the Examiner's rejection, we would need to resort to impermissible speculation or unfounded assumptions or rationales to supply deficiencies for the rejection. *In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967).

For the foregoing reasons, Appellants have persuaded us of error with respect to the rejection under § 102(b) of independent claims 1 and 16 as being anticipated by Phillips '674.[3] We, accordingly, will also not sustain

[3] Since we are persuaded the Examiner erred under § 102(b) in finding that Phillips '674 teaches p-type doped material, we do not reach Appellants'

the Examiner's rejection of dependent claims 2-9 and 12-14 for similar reasons.

Claims 1, 10, and 11

Based on the record, we are persuaded the Examiner did not err under § 102(b) in rejecting claims 1, 10, and 11 as being anticipated by Phillips '337.

Appellants separately argue independent claim 1 (App. Br. 11, 13; Reply Br. 9-11). Accordingly, we select claim 1 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

Initially, Appellants contend the Examiner does not allege Phillips '337 teaches the "claimed bandgap region 'under compressive mechanical strain'" (App. Br. 11). The Examiner does not dispute Appellants' contention, but points out that though "not explicitly stated in the rejection, it is implied in view of the previous analysis and statements" (Ans. 6). Further, the Examiner finds "Figure 1 of Phillips '337 depicts the p^+ base layer 18 made of InSb in contact with two layers 20,26 of InAlSb" (Ans. 6; *accord* FF 7). The Examiner also turns to Appellants' Specification and finds at page 6, lines 9-11, that "the difference in lattice constant between the InSb/InAlSb layer imparts a compressive strain to the narrow band gap base making the presence of this strain an inherent property of the configuration" (Ans. 6; *accord* FF 1-3).

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alternative argument that Phillips '674 fails to teach compressive mechanical strain.

Appellants do not contest that it was known that InSb/InAlSb lattice constant differences impart compressive mechanical strain to InSb. What Appellants argue is that "the Examiner fails to appreciate that in [Phillips '337] Figure 1, [InAlSb] layers 20 and 26 . . . do not even sandwich the [InSb] base layer 18 . . . as disclosed in Appellants' current specification" (Reply Br. 9). Since representative claim 1 does not recite any sandwich structure limitation, we are not persuaded by this argument. Further, Appellants have not cited or submitted evidence that some recited part of claim 1 is to be construed as covering a sandwich structure. *See Superguide*, 358 F.3d at 875.

Appellants also reference Phillips '337 as disclosing layer thicknesses, and then argue that "[t]o the extent that anything is strained, it will be the InAlSb layer[s] and it will be strained in tension and the InSb layer[] will not be significantly strained at all" (Reply Br. 10). Appellants do not address how the asserted Phillips '337 InSb layer "not be[ing] significantly strained at all" avoids reading on the claim 1 recited "at least one narrow bandgap region under compressive mechanical strain." Instead, Appellants assert that "[t]he Examiner has not contended that the narrow bandgap region exists only at the interface of the InSb and InAlSb layers" (Reply Br. 11). What relevance such contention by the Examiner would provide is not explained or argued by Appellants. Further, Appellants have not argued why compressive mechanical strain would be absent from the Phillips '674 InSb/InAlSb interface, and if present why representative claim 1 would not read on the structure. Accordingly, we are not persuaded by these arguments.

We agree with the Examiner's findings that (1) Phillips '337 teaches InSb/InAlSb layers in contact (Ans. 6; FF 7); and (2) Appellants' Specification acknowledges that InSb/$In_{0.85}Al_{0.15}Sb$ contacting layers were known to subject InSb to compressive mechanical strain (FF 1-3). Consequently, we find that Phillips '337 teaches a transistor device with an InSb layer (18) under compressive mechanical strain in at least that portion contacting the $In_{0.85}Al_{0.15}Sb$ layer (20). As such, we find the claim 1 disputed limitation reads on Phillips '337 so as to be anticipated by the reference.

In view of the above discussion, we find the Examiner did not err in rejecting representative claim 1 as being anticipated by Phillips '337. Accordingly, the Examiner's 35 U.S.C. § 102(b) rejection of independent claim 1, as well as not separately argued dependent claims 10 and 11, will be sustained.

CONCLUSIONS

Under § 102(b), Appellants have shown the Examiner erred in rejecting claims 1-9, 12-14, and 16 as being anticipated by Phillips '674.

Under § 102(b), Appellants have not shown the Examiner erred in rejecting claims 1, 10, and 11 as being anticipated by Phillips '337.

DECISION

The Examiner's decision rejecting claims 1, 10, and 11 is affirmed. The Examiner's decision rejecting claims 2-9, 12-14, and 16 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

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